Mondriaan Art by Evolution

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1 Introduction

Here we show an application that generates images resembling art as it was produced by Mondriaan, a Dutch artist, well known for his minimalistic and pure abstract pieces of art. The current version generates images using a linear chromosome and a recursive function as a decoder.

2 Mondriaan's art

Pieter Cornelis Mondriaan (1872–1994) is considered one of the most prominent 20^{th} century geometric painters. In 1917 he and three others founded the journal "De Stijl" wherein Mondriaan published twelve chapters on his vision on new art. Around that time he started painting only in abstract and some years later he took this style one step further by using only primary colors and straight black lines that intersect at right angles. More details on Mondriaan at `http://parallel.park.org/Netherlands/pavilions/culture/mondriaan/eng/`

3 Evolutionary Art

In evolutionary art a computer program is used to develop a piece of work in a manner analogous to natural selection. Pieces of art are represented in some data structure within the computer, we call this the genotype. These representations are then subjected to operations similar to those in biological reproduction: crossover between representations to create new ones and mutations to create small differences.

We want the user to select which pieces of work will have more chance of breeding new pieces of work, but before this is possible the representations have to be presented in some acceptable physical form such as a sound or an image. We call this form the phenotype. Using the force of selection the user is able to steer the computer program into producing a desired piece of work. Similar work in this field has been done by Karl Sims [2].

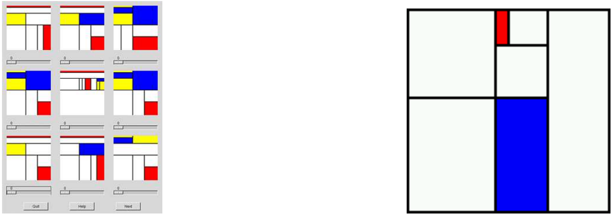

Figure 1: A very small screenshot of the main window (left) and an example output of the Mondriaan Generator (right)

4 The Generator

The first set of nine images are created randomly. The user has to grade the current set of images before pressing the next button to generate a new set of images. These grades will be used to bias the selection of parents mentioned later (see Figure 1).

This version of the Mondriaan Generator uses two chromosomes as the genotype, one for color and one for composition. It transforms the genotype into the phenotype using a recursive function. This function takes the canvas and starts dividing it up into smaller planes using the chromosomes to decide where to split and what colors to use for planes. An example output of the program is in Figure 1.

The genetic operators are very simple: single point crossover and n-point mutation ($n = 6$). To decide which images will be used as parents to breed new ones a k-size tournament selection is used ($k = 4$) [1].

5 Availability and system requirements

The Mondriaan Generator is developed for and under the Linux operating system. It requires the Gtk library (`www.gtk.org`), although a static binary version is available too. Besides for fun, the Mondriaan Generator is used as a student assignment for a practical course in evolutionary algorithms. Source, binaries and assignment are all available at `http://www.liacs.nl/~jvhemert/mondriaan/`.

References

[1] T. Bäck, D. Fogel, and Z. Michalewicz, editors. *Handbook of Evolutionary Computation.* Institute of Physics Publishing Ltd, Bristol and Oxford University Press, New York, 1997.

[2] K. Sims. Artificial evolution for computer graphics. Technical Report TR-185, Thinking Machines Corporation, 1991.